LETTER FROM MTENDELI

An Evaluation of Poor Pregnancy Outcomes Among Burundian Refugees in Tanzania

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Context Little is known about pregnancy outcomes among the approximately 11 million refugees worldwide, 25% of whom are women of reproductive age.

Objective To estimate incidence of and determine risk factors for poor pregnancy outcomes and to calculate the contribution of mortality from neonatal and maternal deaths to overall mortality in a refugee camp.

Design Cross-sectional review of records and survey, conducted in February and March 1998.

Setting Mtendeli refugee camp, Tanzania.

Participants For the overall assessment, 664 Burundi women who had a pregnancy outcome during a recent 5-month period (September 1, 1997–January 31, 1998) and their 679 infants; 538 women (81%) completed the survey.

Main Outcome Measures Incidence of fetal death (fetus born ≥500 g or ≥22 weeks' gestation with no signs of life), low birth weight (≤2500 g), neonatal death (death <28 days of life), and maternal death (deaths during or within 42 days of pregnancy from any cause related to or aggravated by the pregnancy or its management).

Results The fetal death rate was 45.6 per 1000 births, the neonatal mortality rate was 29.3 per 1000 live births, and 22.4% of all live births were low birth weight. Compared with women without poor pregnancy outcome, those with poor pregnancy outcome were more likely to report prior high socioeconomic status (adjusted odds ratio [OR], 1.6; 95% confidence interval [CI], 1.1-2.4), having a first or second pregnancy (OR, 2.2; 95% CI, 1.4-3.4), and having 3 or more episodes of malaria during pregnancy (OR, 2.0; 95% CI, 1.4-3.1). Neonatal and maternal deaths accounted for 16% of all deaths during the period studied.

Conclusions Poor pregnancy outcomes were common in this refugee setting, and neonatal and maternal deaths, 2 important components of reproductive health–related deaths, contributed substantially to overall mortality.

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Approximately 25% of the 11 million refugees throughout the world are women of reproductive age.[1,2] Among women of reproductive age, reproductive health is an important component of overall health, particularly in developing countries where pregnancy and childbirth may pose substantial health risks and where poor birth outcomes are common.[3] These risks may be magnified for women living in refugee settings,[3] where hardship and suffering may contribute to poor health and access to health care services is usually limited.[4]

Until recently, little attention has been given to reproductive health in refugee settings; however, this area is increasingly recognized as an important component of refugee health and well being.[5] For example, the United Nations High Commissioner for Refugees has stated, "While food, water and shelter remain a priority, reproductive health care is among the crucial elements that give refugees basic human welfare and dignity that is their right."[6]

In this study, we assessed an important aspect of reproductive health, pregnancy outcome, among Burundian refugees in Tanzania. We had 3 main objectives: to estimate the incidence of 3 indicators of poor pregnancy outcome—fetal death, neonatal death, and low birth weight; to determine risk factors for these outcomes; and to estimate the contribution of mortality from 2 reproductive health–related causes, neonatal and maternal death, to overall camp mortality.

METHODS

This study was conducted among Burundian refugees in the Mtendeli refugee camp in the Kigoma region of Tanzania during February and March 1998; the camp was established in July 1996. Tanzania is located in East Africa and shares a border with Burundi in the northwest region of the country (FIGURE). Approval for this study was granted by the institutional review board of the Centers for Disease Control and Prevention (CDC), Atlanta, Ga, and the Tanzania Commission for Science and Technology, Dar es Salaam. Informed consent was obtained from all

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Figure. Location of the Mtendeli Refugee Camp

participants; the interviewer provided a written consent form and read and reviewed the form with each potential participant.

In an effort to capture all pregnancy outcomes, we examined existing logbooks from the camp and from the referral hospital, located in a nearby Tanzanian village, about a 1.5-hour drive from the camp. We included in the study population all women from the camp who gave birth to a live born or stillborn infant from September 1, 1997, through January 31, 1998. Information about the pregnancies of all eligible women, such as birth weight, fetal death or neonatal death, and place of delivery, was then abstracted. The maternity logbook for births that occurred in the camp hospital and the logbook of all home births were reviewed. Traditional birth attendants assist with most home births and bring neonates born at home into the camp hospital within 24 hours of delivery to be weighed and registered. Traditional birth attendants also collect and record this information for neonates who are born at home unattended. The grave digger's book was examined to identify fetuses or neonates that died. Burial of fetuses is the custom in this culture, and parents will come to the grave digger to register the death so that they can obtain a burial shroud.

A register that identified women who were referred to the village hospital was reviewed. Delivery logbooks for all vaginal deliveries and the operating theater logbook from all cesarean deliveries were examined to identify refugee women who had delivered at the referral hospital. The inpatient logbook was also checked to ensure that all pregnant refugee women who had been registered at the hospital during the study period were included. After compilation of all pregnancy outcomes identified by the logbooks, the list of women was sorted by address and reviewed by traditional birth attendants for completeness and accuracy. This list most likely included the majority of women with pregnancy outcomes during the study period as it contained all deliveries in the camp or referral hospital, all recorded fetal and neonatal deaths, and all home births (including stillbirths) known to the traditional birth attendants. Typically, each traditional birth attendant is assigned a small area in the camp and knows the women in her area quite well. For example, during each pregnancy a traditional birth attendant is responsible for delivering medications, such as iron and chloroquine, to the homes of each pregnant woman on a weekly basis.

For the first part of this study, we calculated the incidence of 3 measures of poor pregnancy outcome: fetal death, neonatal death, and low birth weight. A fetal death was defined as a fetus weighing 500 g or more or having a gestational age of 22 weeks or longer and born without any signs of life. The fetal death rate is defined as the number of fetal deaths during a specified period per 1000 births during the same period; fetal deaths were counted as births in the denominator.[7] A neonatal death was defined as the death of a live born infant within 28 days of life. The neonatal mortality rate is expressed as the number of neonatal deaths during a specified period per 1000 live births during the same period.[7] The low birth weight percentage was defined as the number of live born infants weighing less than 2500 g divided by all live births with a recorded birth weight.[8]

For our second objective, we investigated potential risk factors for poor pregnancy outcome. We relied on a survey that was administered to all women identified by the logbooks who could be located and agreed to participate in an interview. The 20- to 35-minute survey was conducted in Kirundi, the language of Burundi, by local female refugee interviewers who had received standardized training. The survey had been field tested and validated in developing country populations, including Tanzania and Burundi, and pilot tested in a nearby camp with Burundian refugees.

For the third part of our study, we estimated the contribution of mortality from 2 reproductive health-related causes, neonatal and maternal deaths, to overall camp mortality. Maternal deaths were defined as deaths during or within 42 days of pregnancy from any cause related to or aggravated by the pregnancy or its management.[3] To measure mortality, we found we could not simply use overall camp mortality statistics that had been abstracted from weekly reports compiled by the International Rescue Committee, a nongovernmental organization that administers all health care in the camp. For example, review of the logbooks and risk factor survey identified a number of neonatal deaths that were not included in the camp statistics; these were of neonates born alive who died shortly after birth. They were incorrectly recorded as fetal deaths in the death logbook, even though the newborn either had an Apgar score greater than 0 or had been reported by the mother as born alive but dying shortly after birth. We added these neonatal deaths to the overall camp mortality figures. In addition, we found that maternal deaths were recorded in camp mortality statistics but not identified as maternal deaths; we included those we could identify in our analysis.

In the field, both the preliminary data analysis of the 3 pregnancy outcome measures and the calculation of the contribution of maternal and neonatal mortality to overall camp mortality was performed using *Epi Info*, version 6 (CDC). The data were later converted for use

with a statistical analysis software program (*SAS*; SAS Institute Inc, Cary, NC). For the risk factor survey, unadjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to identify significant predictors of poor outcome. Adjusted analysis was performed to correct for potential confounding; the logistic regression model included all variables that were significant at the $P \leq .20$ level in the univariate analysis, and backward elimination was performed. It is important to note that the reported unadjusted and adjusted ORs should not be interpreted as relative risks.

RESULTS

A total of 664 women were identified as having given birth during the 5-month study period; 538 (81.0%) of these women completed the survey. Of the 126 women who did not, 2 died, 88 voluntarily returned to Burundi, and 36 either were not located or refused to participate. Thus, our participation rate for women who remained in camp was 93.7%.

Summary characteristics for all participants, 65% of whom had arrived in 1996, are shown in TABLE 1. Mean age was 27 years; almost all (98.0%) were married, and most (96.6%) were both married and living with their husbands. Almost all the women (99.0%) had at least 1 prenatal care visit, but most had entered care late, at about 20 to 23 weeks of pregnancy. More than 90% of births were attended by a traditional birth attendant; less than 2% were unattended. Traditional birth attendants, who underwent a 4-week training course taught by nurse midwives in the camp prior to being certified and registered, attended both home deliveries and deliveries in the camp hospital.

The incidence of each of the 3 pregnancy outcomes is shown in TABLE 2 for both the surveyed and overall populations. The overall population comprised 664 women who delivered 679 infants, including 15 sets of twins. This overall population included surveyed women as well as those who died, re-

Table 1. Characteristics of 538 Women With Completed Surveys and Odds Ratios for Poor Outcome of Pregnancy*

Characteristics	No. (%)	Incidence of Poor Outcome, No. (%)	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Age, y				
<20	54 (10.0)	20 (37.0)	1.6 (0.9-2.6)	1.0 (0.5-1.9)
20-34	401 (74.5)	109 (27.2)	Reference	Reference
≥35	83 (15.4)	12 (14.5)	0.5 (0.2-0.9)	0.7 (0.3-1.3)
Marital status‡				
Married	527 (98.0)	137 (26.0)	0.7 (0.2-2.6)	...
Married, living with husband	520 (96.6)	137 (26.3)	0.3 (0.1-5.8)	...
Prior socioeconomic status				
High	295 (54.8)	91 (30.8)	1.7 (1.2-2.6)	1.6 (1.1-2.4)
Low	243 (45.2)	50 (20.6)	Reference	Reference
Literacy				
Literate	330 (61.3)	94 (28.5)	1.4 (0.9-2.0)	1.2 (0.8-1.8)
Illiterate	208 (38.7)	47 (22.6)	Reference	Reference
Current food supply†				
Not enough	293 (54.9)	79 (27.0)	1.1 (0.7-1.6)	...
Enough	242 (45.2)	61 (25.2)	Reference	...
Received food ration				
Male	327 (60.8)	86 (26.3)	1.0 (0.7-1.5)	...
Female	211 (39.2)	55 (26.1)	Reference	...
Use of birth control‡				
In Burundi				
Yes	66 (12.3)	10 (15.2)	Reference	Reference
No	472 (87.7)	131 (27.7)	2.1 (1.1-4.3)	1.9 (0.9-3.9)
In refugee camp†				
Yes	45 (8.4)	13 (28.9)	1.2 (0.6-2.3)	...
No	491 (91.6)	127 (25.9)	Reference	...
Intendedness of pregnancy†				
Planned	436 (82.6)	125 (28.7)	...	...
Mistimed	62 (11.7)	10 (16.1)	0.5 (0.2-1.0)	...
Unwanted	30 (5.7)	4 (13.3)	0.4 (0.1-1.1)	...
No. of children†				
≤2	273 (55.5)	92 (33.7)	2.2 (1.4-3.4)	...
>2	219 (44.5)	41 (18.7)	Reference	...
No. of pregnancies				
1-2	220 (40.9)	82 (37.3)	2.6 (1.8-3.8)	2.2 (1.4-3.4)
>2	318 (59.1)	59 (18.6)	Reference	Reference
Malaria in pregnancy†				
Yes	328 (61.4)	94 (28.7)	1.4 (0.9-2.0)	...
No	206 (38.6)	47 (22.8)	Reference	...
No. of episodes of malaria during pregnancy				
<3	342 (63.6)	70 (20.5)	Reference	Reference
≥3	196 (36.4)	71 (36.2)	2.2 (1.5-3.2)	2.0 (1.4-3.1)
Place of delivery†				
Home	274 (51.6)	59 (21.5)	0.6 (0.4-1.0)	...
Hospital	257 (48.4)	80 (31.1)	Reference	...
Birth attendant†				
Traditional birth attendant	502 (94.7)	125 (24.9)	Reference	...
Physician/medical assistant	9 (1.7)	6 (66.7)	6.0 (1.0-20.6)	...
Nurse/midwife	18 (3.4)	8 (44.4)	2.4 (0.9-6.1)	...
Family/friend (untrained)	1 (0.2)	0 (0)	1.0 (0.1-24.8)	...

*Poor outcome of pregnancy is defined as fetal death (fetus born ≥500 g or ≥22 wk with no signs of life), neonatal death (death ≤28 days of life), low birth weight (<2500 g), or maternal death (deaths during or within 42 days of pregnancy from any cause related to or aggravated by the pregnancy or its management). CI indicates confidence interval; ellipses, variable not included in final model. Totals may not sum to 100% due to rounding.
†Sample size is decreased due to missing data.
‡Categories not mutually exclusive.

Table 2. Incidence of Poor Pregnancy Outcomes*

	No./Total	
	Surveyed Population	Overall
Fetal death rate	39.0 (21/538)	45.6 (31/679)
Neonatal mortality rate	23.2 (12/517)	29.3 (19/648)
Low birth weight, %	22.6 (116/513)	22.4 (138/617)

*Fetal death rate is defined as number of fetal deaths during a specified period per 1000 births during the same period; fetal deaths were counted as births in the denominator. Neonatal mortality rate is expressed as number of neonatal deaths during a specified period per 1000 live births during the same period. Low birth weight percentage was defined as percentage of live born infants weighing less than 2500 g divided by all live births with a recorded birth weight.

Table 3. Major Causes of Death Among Burundian Refugees in Mtendeli Refugee Camp, September 1, 1997–January 31, 1998 (Total Deaths = 134)

Cause of Death	Percentage
Malaria	41
Acute respiratory tract infection	22
Reproductive health–related *	16
Anemia	12
Diarrhea	4
Malnutrition	3
Other	3

*Maternal and neonatal deaths have been reclassified as reproductive health–related deaths.

turned to Burundi, were not located, or refused participation. In this population, the fetal death rate was 45.6 per 1000 births; the neonatal mortality rate, 29.3 per 1000 live births; and the percentage of low birth weight, 22.4%.

Because preliminary analyses showed that the 3 pregnancy outcome measures (fetal death, neonatal death, and low birth weight) had similar risk factors, we combined them into a single measure of poor outcome. Both adjusted and unadjusted ORs for the combined outcome measure are shown in Table 1.

In the univariate analysis, 5 factors were found to be positively associated with poor outcome: prior high socioeconomic status, defined as having lived in a household in Burundi with electricity, a radio, a television, or a refrigerator prior to becoming a refugee; having not used birth control in Burundi; having 2 or fewer children in the household; having a first or second pregnancy; and having had 3 or more episodes of malaria during the pregnancy being analyzed. Compared with women who did not have a poor pregnancy outcome, women with a poor pregnancy outcome were more likely to be aged 35 years or older. Since first and second pregnancies had similar percentages for poor outcome, 38.8% and 34.3% respectively, they were combined into a dichotomous variable (≤ 2, >2 pregnancies). Because the number of pregnancies and the number of children in the household were found to be somewhat colinear, we used only the number of pregnancies in the final model. Multiple measures of high socioeconomic status were used and included bicycle ownership (45%), having a flush toilet (4.3%), and living in a house with wood, tile, or cement floors (24%). Use of different definitions for high socioeconomic status did not substantially alter the association. Factors considered in the univariate analysis and not found to be significantly associated with pregnancy outcome included education, literacy, multiple measures of food supply, marital status, having a mistimed or unwanted pregnancy, use of birth control in the camp, place of delivery, and birth attendant.

In the adjusted analyses, women with a poor pregnancy outcome were more likely to have high prior socioeconomic status, first or second pregnancy, and 3 or more episodes of malaria during the pregnancy compared with women who did not have a poor pregnancy outcome. Although more than 60% of women reported 1 or more episodes of malaria during their pregnancy (Table 1), only 4% of women reported having had malaria prior to migration from Burundi. Although 3 or more episodes of malaria was a risk factor for poor outcome, when malaria exposure was defined as 1 or more episodes during pregnancy, a significant association was not found. Ninety percent of survey participants reported taking weekly chloroquine prophylaxis during pregnancy, which was delivered to their houses by the traditional birth attendants.

During the study period, there were 19 neonatal deaths (4 previously misclassified as fetal deaths) and 2 maternal deaths, neither of which had previously been classified as pregnancy-related. During the same period, there were 134 deaths in the camp overall. Thus, reproductive health–related mortality due to neonatal and maternal deaths accounted for 16% of overall camp mortality and ranked third behind malaria and acute respiratory infection as a cause of death (TABLE 3).

COMMENT

In the first part of this study, we found high rates of poor pregnancy outcome with an overall fetal death rate of 45.6 per 1000 births, a neonatal mortality rate of 29.3 per 1000 live births, and 22.4% low birth weight (<2500 g). To place these figures in their proper context, the most appropriate comparison would be to rates of poor pregnancy outcome among this same population prior to becoming refugees. Unfortunately, these data are not available. In such cases where comparison data regarding reproductive health status prior to becoming a refugee are not available, some refugee health experts advocate using health measures of the host country population for comparison.[9] For example, the low birth weight percentage in Tanzania in 1990 was 14%,[8] indicating that the host country has a lower incidence than the refugee population. The high rates of poor pregnancy outcome in this refugee population, compared with the host population, suggest that refugee women may be a particularly vulnerable group.

The collection of data in this refugee setting was challenging and several problems with the accurate ascertainment of fetal death, neonatal death, and low birth weight were encountered. First, some neonatal deaths were mis-

classified as fetal deaths. Although we reclassified some of these by interviewing the mothers and checking the delivery logs, it is likely that we missed others. Second, although the grave digger kept a log of fetal deaths, some fetal deaths, particularly earlier in gestation, may not have been brought by the mother to the grave digger to be registered. A third concern is that the low birth weight percentage may have been underestimated. Rather than being smooth, the birth weight distribution had unusually large spikes at several points (2000, 2500, 3000, and 3500 g), probably due to "rounding off" of birth weights. It is quite likely that some newborns recorded as 2500 g actually weighed slightly less and should have been considered low birth weight.

In the second part of this study, we identified 3 risk factors for poor pregnancy outcome: having a first or second pregnancy, prior high socioeconomic status, and 3 or more episodes of malaria during pregnancy. The association between low parity and poor outcome may be explained in part by the tendency of birth weights to increase with subsequent pregnancies.[10] As for the second finding, previous studies of both developed and developing countries have shown high socioeconomic status to be generally protective against poor pregnancy outcome,[11] but a Danish study published in 1997 found that a recent decline in social status independently predicted low birth weight.[12] In the Mtendeli refugee camp, assuming that all the women lived under similar conditions, those from higher socioeconomic households would have suffered the greatest decline in social status. Women who were economically advantaged in Burundi may lack skills, such as collecting firewood and gardening, which would be of benefit to them in the refugee setting. Furthermore, decline in social status may cause psychological stress that might adversely impact pregnancy. Alternatively, women with prior high economic status may also have had a higher seroprevalence of human immunodeficiency virus (HIV), which we could not measure. In other East African settings, high socioeconomic status has been associated with increased HIV seropositivity,[13,14] and HIV seropositivity, in turn, has been associated with increased rates of poor pregnancy outcomes.[15]

Three or more self-reported episodes of malaria during pregnancy was found to be a risk factor for poor outcome. By self-report, prior history of malaria among this population was relatively uncommon, with only 4% of survey participants reporting episodes of malaria prior to coming to Tanzania. Although we have no information to validate the accuracy of a history of self-reported malaria, low rates of malaria have been documented in certain areas of Burundi.[16] In malaria endemic areas, malaria has been shown to adversely affect pregnancy outcomes, such as birth weight.[17] There is less information on the consequences of malaria for women who have not previously lived in malaria endemic areas. Despite high reported compliance rates with weekly chloroquine prophylaxis, there was a high reported incidence of malaria in pregnancy. This may be attributable to high rates of chloroquine resistance: the unpublished rates of treatment failures with chloroquine range from 25% to 57% in Tanzania (T.K. Mutabingwa, National Institute of Medical Research, Dar es Salaam, Tanzania, oral communication, November 1999). In settings with chloroquine-resistance, the use of effective antimalarial drugs other than chloroquine during pregnancy[17] has been recommended.

Several important limitations of this study relate primarily to the risk factor analysis. First, about 20% of the women identified in the logbooks did not participate in the survey. We were able to include their data in our calculations of the incidence of the 3 principal outcome measures. However, we could not obtain information on risk factors for these women and including them in our univariate and multivariate analyses might have changed those results. Second, women who had a poor pregnancy outcome may have remembered their pregnancies differently than did those who had a healthy newborn, thereby introducing recall bias. However, in this culture, recall bias associated with low birth weight is unlikely, since low birth weight is not viewed as an adverse event. Third, there was incomplete ascertainment of important risk factors known to increase the risk of poor pregnancy outcome, such as syphilis[18] and, as noted, HIV seropositivity. Syphilis screening during pregnancy was not perfomed in the camp. Fourth, as previously mentioned, risk factors such as malaria were ascertained by self-report because laboratory confirmation was not possible. Fifth, despite debates about the appropriate measure of association for cross-sectional studies,[19] we have chosen to report unadjusted and adjusted ORs, which should not be misinterpreted as relative risks.

In the third part of our study, we examined the contribution of neonatal and maternal deaths to overall camp mortality and found that these 2 types of reproductive health–related mortality accounted for 16% of overall camp mortality. We chose to classify neonatal deaths as reproductive health–related deaths since death around the time of birth is largely affected by events during pregnancy and birth. Maternal mortality is an important measure of reproductive health, as well as a basic indicator reflecting the overall health of a population.[20]

Unfortunately, we have limited clinical information about maternal and neonatal deaths. Although investigations of maternal deaths are not routinely performed, we have some information about the 2 maternal deaths, based on discussions with health care workers in the camp. In 1 case, the woman had intrapartum seizures and was being treated for presumed eclampsia. She died shortly after delivery, and it was later determined that she had undiagnosed cerebral malaria. In the other case, the woman died from sepsis following an emergent cesarean delivery. We have no additional clinical information about the neonatal deaths.

There are several limitations in our calculation of the contribution of neonatal and maternal deaths that qualify

their interpretation. First, it is likely that we underascertained such deaths since there was no established system for counting maternal deaths. We were able to verify that 2 women died shortly after delivery from obstetric complications, but it is likely that we missed other maternal deaths. Second, each death, whether neonatal or maternal, was counted once. By counting these deaths equally, we underestimate the potentially catastrophic effects the death of a mother may have on a household, particularly when she leaves behind young children who depend on her care. Third, in this calculation, a clear distinction was made between fetal and neonatal deaths. From the data collection viewpoint, the distinction between fetal and neonatal deaths is important because neonatal deaths, but not fetal deaths, are included in overall mortality statistics. However, from the point of view of the mother, who carries a pregnancy to term or near term, the distinction between a baby that dies shortly before birth and a baby that dies shortly after birth may not be as important. Both cases represent a tragic outcome for the woman who in neither case has a living baby. Fourth, we used enhanced surveillance to detect neonatal and maternal deaths by looking through logbooks and interviewing mothers. By contrast, we relied on routine surveillance measures for calculation of overall mortality rates for deaths due to other causes. This may have led to an overestimation of the contribution of these 2 causes of deaths to overall mortality.

A final note of caution is that this report on 2 important components of reproductive health–related mortality, neonatal and maternal deaths, deals only with a fraction of reproductive health–related deaths and their causes. Other important reproductive health–related deaths and their causes, such as bleeding associated with a spontaneous abortion or ectopic pregnancy, or death from septic abortion, were not included in this analysis.

In summary, this study is one of the first reports that describes pregnancy outcomes among refugee women and documents the contribution of neonatal and maternal deaths to overall mortality in a refugee camp. These findings highlight the importance of reproductive health in refugee settings. Further research in this area is needed to clearly characterize the scope of the problem so that appropriate interventions can be designed.

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